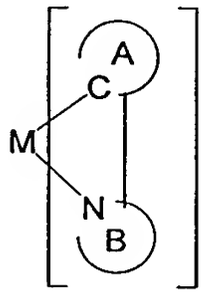
CLAIMS

Sub B1

1. A metal coordination compound having at least one partial structure represented by formula (1) below:

ML (1),

wherein the partial structure ML is represented by formula (2) below:



(2),

wherein M is a metal atom of Ir, Pt, Rh or Pd; N and C are nitrogen and carbon atoms, respectively; A is a cyclic group capable of having a substituent, including the carbon atom and bonded to the metal atom M via the carbon atom; B is an isoquinolyl group capable of having a substituent, including the nitrogen atom and bonded to the metal atom M via the nitrogen atom, with the proviso that one or two of CH groups forming the isoquinolyl group can be replaced with a nitrogen atom and the cyclic group A is coordination-bonded to a position-1 carbon atom of the isoquinolyl group;

the optional substituent of the cyclic groups is selected from a halogen atom, a cyano group, a nitro group, a di-substituted amino group {of which

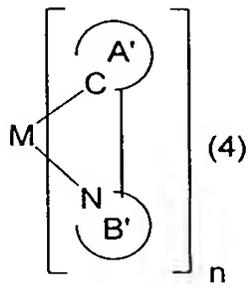
substituents are independently a phenyl group or a naphthyl group each capable of having a substituent (which is selected from a halogen atom, a methyl group or a trifluoromethyl group), or a linear or branched alkyl group having 1 to 8 carbon atoms and including a hydrogen atom optionally replaced with a fluorine atom}, a trialkylsilyl group of which the alkyl groups are independently a linear or branched alkyl group having 1 to 8 carbon atoms, or a linear or branched alkyl group having 1 to 20 carbon atoms {of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH-, -C≡C-, or a divalent aromatic group capable of having a substituent (that is a halogen atom, a cyano atom, a nitro atom, a trialkylsilyl group (of which the alkyl groups are independently a linear or branched alkyl group), a linear or branched alkyl group having 1 to 20 carbon atoms (of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C-, and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom)), and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom}, with the proviso that an adjacent pair of substituents can be bonded to form

a cyclic structure.

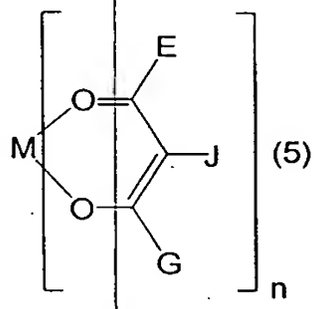
2. A metal coordination compound according to Claim 1, represented by formula (3) below:

$$ML_mL'_n \qquad (3),$$

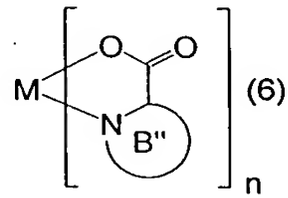
wherein M is a metal atom of Ir, Pt, Rh or Pd; L and L' are mutually different bidentate ligands; m is 1, 2 or 3 and n is 0, 1 or 2 with the proviso that m+n is 2 or 3; a partial structure ML'_n is represented by formula (4), (5) or (6) shown below:



(4)



(5)



(6)

wherein N and C are nitrogen and carbon atoms, respectively; A' is a cyclic group capable of having a substituent, including the carbon atom and bonded to the metal atom M via the carbon atom; B' and B" are each cyclic group capable of having a substituent, including the nitrogen atom and bonded to the metal atom M via the nitrogen atom with the proviso that the cyclic group A' and the cyclic group B' are coordination-bonded to each other;

the optional substituent of the cyclic groups is selected from a halogen atom, cyano group, a nitro

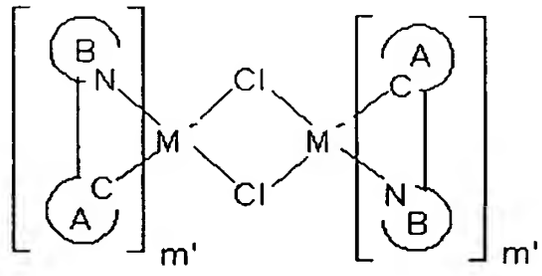
group, a di-substituted amino group {of which substituents are independently a phenyl group or a naphthyl group each capable of having a substituent (which is selected from a halogen atom, a methyl group or a trifluoromethyl group), or a linear or branched alkyl group having 1 to 8 carbon atoms and including a hydrogen atom optionally replaced with a fluorine atom}, a trialkylsilyl group of which the alkyl groups are independently a linear or branched alkyl group having 1 to 8 carbon atoms, or a linear or branched alkyl group having 1 to 20 carbon atoms {of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH-, -C≡C-, or a divalent aromatic group capable of having a substituent (that is a halogen atom, a cyano atom, a nitro atom, a trialkylsilyl group (of which the alkyl groups are independently a linear or branched alkyl group), a linear or branched alkyl group having 1 to 20 carbon atoms (of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C-, and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom)), and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom}, with the proviso that

an adjacent pair of substituents can be bonded to form a cyclic structure; and

E, G and J are independently a linear or branched alkyl group having 1 to 20 carbon atoms {of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH-, -C≡C-, or a divalent aromatic group capable of having a substituent (that is a halogen atom, a cyano atom, a nitro atom, a trialkylsilyl group (of which the alkyl groups are independently a linear or branched alkyl group), a linear or branched alkyl group having 1 to 20 carbon atoms (of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C-, and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom) with the proviso that an adjacent pair of substituents can be bonded to form a cyclic structure), and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom}, or di-substituted amino group {of which substituents are independently a phenyl group or a naphthyl group each capable of having a substituent (which is selected from a halogen atom, a methyl group or a trifluoromethyl group), or a linear or branched alkyl group having 1 to 8 carbon atoms and including a

hydrogen atom optionally replaced with a fluorine atom}, and J can also be a hydrogen atom.

3. A metal coordination compound according to Claim 1, represented by formula (7) below:



(7),

wherein Cl denotes a chlorine atom, M' denotes iridium Ir or rhodium Rh, and m' is 2.

4. A metal coordination compound according to Claim 2, including a partial structure ML'_n represented by the formula (4) in the formula (3).

5. A metal coordination compound according to Claim 2, including a partial structure ML'_n represented by the formula (5) in the formula (3).

6. A metal coordination compound according to Claim 2, including a partial structure ML'_n represented by the formula (6) in the formula (3).

7. A metal coordination compound according to

Claim 2, wherein n is 0 in the formula (3).

8. A metal coordination compound according to Claim 2, wherein the cyclic groups A and A' are independently selected from phenyl group, naphthyl group, thienyl group, fluorenyl group, thianaphthyl group, acenaphthyl group, anthranyl group, phenanthrenyl group, pyrenyl group, or carbazolyl group, as an aromatic cyclic group capable of having a substituent with the proviso that the aromatic cyclic group can include one or two CH groups that can be replaced with a nitrogen atom.

9. A metal coordination compound according to Claim 8, wherein the cyclic groups A and A' are selected from phenyl group, 2-naphthyl group, 2-thienyl group, 2-fluorenyl group 2-thianaphthyl group, 2-anthranyl group, 2-phenanthrenyl group, 2-pyrenyl group, or 3-carbazolyl group, as an aromatic cyclic group capable of having a substituent with the proviso that the aromatic cyclic group can include one or two CH groups that can be replaced with a nitrogen atom.

10. A metal coordination compound according to Claim 9, wherein the aromatic cyclic group is phenyl group capable of having a substituent.

11. A metal coordination compound according to Claim 10, wherein a hydrogen atom is attached to a position-6 carbon atom of the phenyl group capable of having a substituent next to a position-1 carbon atom bonded to the cyclic group B.

12. A metal coordination compound according to Claim 2, wherein the cyclic groups B' and B" are independently selected from isoquinolyl group, quinolyl group, 2-azaanthranyl group, phenanthridinyl group, pyridyl group, oxazolyl group, thiazolyl group, benzoxazolyl group, or benzthiazolyl group, as an aromatic cyclic group capable of having a substituent with the proviso that the aromatic cyclic group can include one or two CH groups that can be replaced with a nitrogen atom.

13. A metal coordination compound according to Claim 12, wherein the cyclic groups B' and B" are selected from isoquinolyl group or pyridyl group, as an aromatic cyclic group capable of having a substituent with the proviso that the aromatic cyclic group can include one or two CH groups that can be replaced with a nitrogen atom.

14. A metal coordination compound according to Claim 2, wherein the cyclic group B' in the formula

(4) is isoquinolyl group capable of having a substituent.

15. A metal coordination compound according to Claim 2, wherein the cyclic groups A, A', B, B' and B" are independently non-substituted, or have a substituent selected from a halogen atom or a linear or branched alkyl group having 1 to 20 carbon atoms {of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH-, -C≡C-, or a divalent aromatic group capable of having a substituent (that is a halogen atom, or a linear or branched alkyl group having 1 to 20 carbon atoms (of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom)), and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom}.

16. A metal coordination compound according to Claim 3, wherein the cyclic group A in the formula (7) is selected from phenyl group, naphthyl group, thienyl group, fluorenyl group, thianaphthyl group, acenaphthyl group, anthranyl group, phenanthrenyl

group, pyrenyl group, or carbazolyl group, as an aromatic cyclic group capable of having a substituent with the proviso that the aromatic cyclic group can include one or two CH groups that can be replaced with a nitrogen atom.

17. A metal coordination compound according to Claim 16, wherein the aromatic cyclic group is selected from phenyl group, 2-naphthyl group, 2-thienyl group, 2-fluorenyl group, 2-thianaphthyl group, 2-anthranyl group, 2-phenanthrenyl group, 2-pyrenyl group or 3-carbazolyl group, each capable of having a substituent with the proviso that the aromatic cyclic group can include one or two CH groups that can be replaced with a nitrogen atom.

18. A metal coordination compound according to Claim 17, wherein the aromatic cyclic group is phenyl group capable of having a substituent.

19. A metal coordination compound according to Claim 18, wherein a hydrogen atom is attached to a position-6 carbon atom of the phenyl group capable of having a substituent next to a position-1 carbon atom bonded to the cyclic group B.

20. A metal coordination compound according to

Claim 3, wherein the cyclic groups A and B in the formula (7) are independently non-substituted, or have a substituent selected from a halogen atom or a linear or branched alkyl group having 1 to 20 carbon atoms {of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH-, -C≡C-, or a divalent aromatic group capable of having a substituent (that is a halogen atom, a cyano atom, a nitro atom, a trialkylsilyl group (of which the alkyl groups are independently a linear or branched alkyl group), a linear or branched alkyl group having 1 to 20 carbon atoms (of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom)), and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom}.

21. A metal coordination compound according to Claim 1, wherein M in the formula (1) is iridium.

22. A metal coordination compound according to Claim 3, wherein M in the formula (7) is iridium.

23. A metal coordination compound according to

Claim 1 or 2, having a partial structure ML represented by the formula (2) and represented by formula (8) below:

$$Ir[Rp\text{-}Ph\text{-}IsoQ\text{-}R'q]_3 \qquad (8),$$

wherein Ir is iridium; partial structure Ph-IsoQ denotes 1-phenylisoquinolyl group; substituents R and R' are selected from hydrogen, fluorine or a linear or branched alkyl group represented by C_nH_{2n+1} (wherein H can be replaced with F, a non-adjacent methylene group can be replaced with oxygen and n is an integer of 1 to 20), p and q are integers of at least 1 representing numbers of the substituents R and R' bonded to the phenyl group and the isoquinolyl group, respectively, wherein a position-2 carbon atom of the phenyl group and a nitrogen atom of IsoQ are coordination-bonded to Ir.

24. A metal coordination compound according to Claim 23, wherein the partial structure Rp-Ph is 4-alkylphenyl group in the formula (8), and the substituent R' is hydrogen.

25. A metal coordination compound according to Claim 23, wherein in the formula (8), the substituent R is hydrogen, and R'q represents a fluoro or trifluoromethyl group substituted at a 4- or 5-position.

26. A metal coordination compound according to Claim 23, wherein in the formula (8), the partial structure Rp-Ph- is 5-fluorophenyl group, and R'q is a hydrogen atom or a fluorine atom or trifluoromethyl group substituted at a 4- or 5-position.

27. A metal coordination compound according to Claim 23, wherein in the formula (8), the partial structure Rp-Ph- is 4-fluorophenyl group, and R'q is a hydrogen atom or a fluorine atom or trifluoromethyl group substituted at a 4- or 5-position.

28. A metal coordination compound according to Claim 23, wherein in the formula (8), the partial structure Rp-Ph- is 3,5-difluorophenyl group, and R'q is a hydrogen atom or a fluorine atom or trifluoromethyl group substituted at a 4- or 5-position.

29. A metal coordination compound according to Claim 23, wherein in the formula (8), the partial structure Rp-Ph- is 3,4,5-trifluorophenyl group, and R'q is a hydrogen atom or a fluorine atom or trifluoromethyl group substituted at a 4- or 5-position.

30. A metal coordination compound according to

Claim 23, wherein in the formula (8), the partial structure Rp-Ph- is 4-trifluoromethylphenyl group, and R'q is a hydrogen atom or a fluorine atom or trifluoromethyl group substituted at a 4- or 5-position.

31. A metal coordination compound according to Claim 23, wherein in the formula (8), the partial structure Rp-Ph- is 5-trifluoromethylphenyl group, and R'q is a hydrogen atom or a fluorine atom or trifluoromethyl group substituted at a 4- or 5-position.

32. A metal coordination compound according to Claim 23, wherein in the formula (8), the structure Rp-Ph is a 1-(3,4,5,6-tetrafluoromethyl)phenyl group, and in R'q, q is 1 or 6 and R' is a hydrogen atom or a trifluoromethyl group or 3,4,5,6,7,8-hexafluoro group substituted at a 4- or 5-position.

33. A metal coordination compound according to Claim 23, wherein in the formula (8), the partial structure Rp-Ph- is 4-alkylphenyl group (wherein the alkyl group is a linear or branched alkyl group having 1 to 6 carbon atoms), and R'q is hydrogen.

34. A metal coordination compound according to

Claim 23, wherein in the formula (8), the partial structure Rp-Ph- is 4-alkoxyphenyl group (wherein the alkoxy group is a linear or branched alkoxy group having 1 to 6 carbon atoms), and R'q is hydrogen.

35. A metal coordination compound according to Claim 23, wherein in the formula (8), the partial structure Rp-Ph- is 4-trifluorooxyphenyl group, and R'q is a hydrogen atom or a fluorine atom or trifluoromethyl group substituted at a 4- or 5-position.

36. A metal coordination compound according to Claim 2, which is represented by the formula (3) and is also represented by formula (9) below:

$$IrL_mL'_n \qquad (9),$$

wherein Ir represents iridium.

37. A metal coordination compound according to Claim 36, represented by the formula (9), wherein L_m is represented by a formula of [4-alkylphenyl-isoquinoline]$_2$ (wherein the alkyl group is represented by C_nH_{2n+1} and n is an integer of 1 to 8), and L'_n is 1-phenylisoquinoline.

38. A metal coordination compound according to Claim 36, represented by the formula (9), wherein L_m

is represented by a formula $[1\text{-phenylisoquinoline}]_2$, and L'_n is 4-alkylphenylisoquinoline (wherein the alkyl group has 1 to 8 carbon atoms).

39. A metal coordination compound according to Claim 1, wherein one or two CH groups in the isoquinolyl group capable of having a substituent in the formula (1) are replaced with a nitrogen atom.

40. A metal coordination compound according to Claim 3, wherein one or two CH groups in the isoquinolyl group capable of having a substituent in the formula (7) are replaced with a nitrogen atom.

41. An organic luminescence device, comprising: a pair of electrodes disposed on a substrate, and a luminescence unit comprising at least one organic compound disposed between the electrodes, wherein the organic compound comprises a metal coordination compound having at least one partial structure represented by the formula (1) in Claim 1.

42. An organic luminescence device according to Claim 41, wherein the organic compound comprises a metal coordination compound having a structure represented by the formula (3).

43. An organic luminescence device according to Claim 41, wherein the organic compound comprises a metal coordination compound having a structure represented by the formula (8).

44. An organic luminescence device according to Claim 41, wherein the organic compound comprises a metal coordination compound having a structure represented by the formula (9).

45. An organic luminescence device according to Claim 41, wherein a voltage is applied between the electrodes to emit phosphorescence.

46. An organic luminescence device according to Claim 45, wherein the phosphorescence is red in luminescence color.

47. A picture display apparatus, comprising an organic luminescence device according to any of Claims 41 to 46, and a means for supplying electric signals to the organic luminescence device.